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Numerical simulations of blob dynamics with finite ion temperature

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In this paper we set out to numerically simulate the turbulent transport in the edge and scrape off layer (SOL) regions on the outboard midplane of the medium sized tokamak such as ASDEX Upgrade or EAST. We study the perpendicular particle and energy transport across the Last Closed Flux Surface (LCFS) using the 2-dimensional numerical model, HESEL[1]. HESEL is an energy conserving four-field model based on the Braginskii equations governing the dynamics of a quasi-neutral, simple plasma. It describes interchange-driven, low-frequency turbulence in a plane perpendicular to the magnetic field at the outboard midplane. The HESEL model includes effects of drift waves on closed field lines, the transition from the confined region to the region of open field lines (SOL) and the full development of the profiles across the LCFS. HESEL is also fully compatible with scientific workflow designed and engineered in Kepler, which in this paper shortly will be discussed.

In Fig. 1 we show a snapshot of 2 blobs being ejected from the edge area. In such processes particles and energy are transported very effectively and intermittently far into the SOL. One observes an asymmetry between the temperatures of electron and ion, a result of difference dissipation rates parallel and perpendicular to the magnetic field lines.

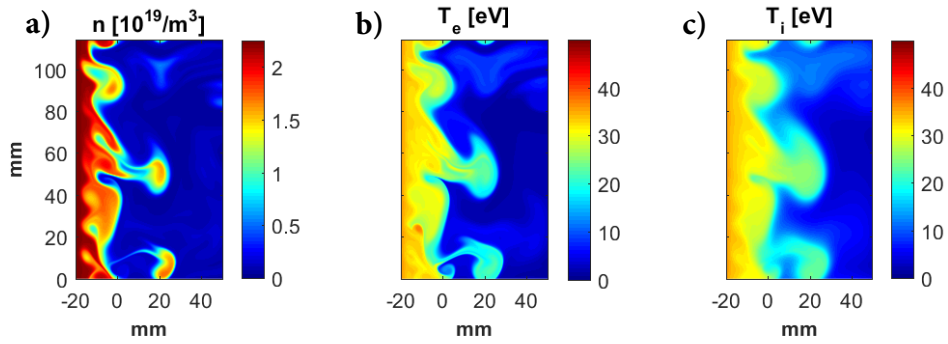

Figure 1: Snapshot of a HESEL simulation a) density, b) electron temperatures, and c) ion temperature.

References

[1] A.H. Nielsen, *et al*, Physics Letters A **379** 3097–3101 (2015)